

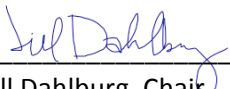
NASA ADVISORY COUNCIL

HELIOPHYSICS SUBCOMMITTEE

August 8-9, 2016

NASA Headquarters
Washington, D.C.

MEETING MINUTES

 _____ 12 September 2016 _____
Jill Dahlburg, Chair

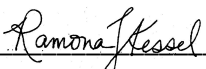
 _____ 13 September 2016 _____
Ramona Kessel, Executive Secretary

Table of Contents

Welcome, Overview of Agenda	3
Heliophysics Division Overview	3
Flight Program Status	4
Heliophysics Science Performance Assessment Review	5
Heliophysics Science Performance Assessment, Input for the FY2016 NASA PAR – Review and Assignments	6
Science Presentation: NExSS: The Nexus of Exoplanet System Science, an Interdivisional Research Initiative	6
Subcommittee Work Session	7
High-End Computing Status	7
Risk Tolerance/CubeSats	9
Discussion/Adjourn for the Day	9
Call to Order	10
R&A Update/Compliance	10
SWAP/LWS Update	12
Heliophysics Science Performance Assessment, Input for the FY2016 NASA PAR – Working	13
Panel Surveys	13
Discussion	13
Heliophysics Science Performance Assessment, Input for the FY2016 NASA PAR – Final Work and Voting	14
Discussion	15
Debrief with Heliophysics Director	15
Adjourn	17

Appendix A- Attendees

Appendix B-Membership Roster

Appendix C-Presentations

Appendix D-Agenda

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Ingenicomm*

Monday, August 8, 2016

Welcome, Overview of Agenda

Dr. Jill Dahlburg, Chair of the Heliophysics Subcommittee (HPS) of the NASA Advisory Committee (NAC), opened the meeting by briefly recapping the previous HPS meeting. She then reviewed the agenda for the current meeting. The primary work for this meeting was to produce the Government Performance and Results Act (GPRA) Modernization Act (GPRAMA) assessment of NASA's Heliophysics Division (HPD) activities over the last year. Finally, Dr. Dahlburg welcomed two new Subcommittee members, Drs. John Leibacher and William Matthaeus. A third new member, Dr. Lynn Kistler, was unable to attend.

Heliophysics Division Overview

Mr. Steven Clarke, HPD Director, welcomed the Subcommittee members. He began his Division overview by showing a budget pie chart for Fiscal Year 2016 (FY16). Over half of the enacted budget of \$647.5 million goes to missions in development, with the rest distributed among Research and Analysis (R&A), operating missions, suborbital missions, prime missions (currently the Magnetosphere Multiscale (MMS)), data systems, and management/other. For FY17, the President's Budget Request (PBR) is \$698.7 million, and the extended (notional) budget supports future missions as planned. This will allow HPD to increase the cadence of mission opportunities, such as having new Explorers every 2 years. The Office of Management and Budget (OMB) "mandatory spending" for FY17 has \$10 million for the cubesat program, \$10 million for space weather research in support of the Space Weather Action Plan (SWAP), and \$5 million for R&A. This seems to reflect OMB understanding that HPD does not want to shift funds from R&A to cover activities related to SWAP. Dr. Heather Elliott asked about plans for the Solar Terrestrial Probe (STP) and Living with a Star (LWS) missions. Mr. Clarke said that those reflect the Decadal Survey (DS), but in a broad sense, keyed on science objectives and priorities.

The mission status spotlight chart shows that all operating missions are rated green. As has been the case for a while, the Solar TERrestrial RELations Observatory (STEREO) B spacecraft was off-line. There is a plan to attempt communications monthly through July 2017, then discontinue the effort until it comes back into range. STEREO A continues to provide good data. The Interstellar Boundary Explorer (IBEX) and MMS had star tracker issues that have been resolved, and a resolution is imminent for the star tracker issues associated with the Interface Region Imaging Spectrograph (IRIS).

In presenting the program overview, Mr. Clarke noted that the Space Environment Test (SET) bed was delivered a while ago and is now with the Air Force. The launch, to occur on a SpaceX Falcon Heavy, will occur no earlier than March 2017 and is likely to be later. The final results for the Research Opportunities in Space and Earth Sciences (ROSES) 2015 resulted in an 18 percent success rate, slightly better than the rate in 2014.

Mr. Clarke next presented the HPD organizational chart. Dr. Jeffrey Newmark left the Division to become the Deputy Associate Administrator for Research for NASA's Science Mission Directorate (SMD). Dr. Guan Le is also now with SMD. Although NASA is under a hiring freeze at Headquarters, Mr. Clarke received a waiver to go outside NASA in order to fill these vacancies. In addition, he is looking at bringing in detailees and program science expertise. Dr. Liz McDonald of Goddard Space Flight Center (GSFC) is working for HPD 3 days a week. Mr. Clarke described several other new personnel actions and noted that interviewing for the chief scientist position was about to start.

He heard the feedback from HPS and the community about the need to help new technologists and scientists build their careers. This will be a topic for a future meeting, but he is looking at shifting seed money into an initial effort that would infuse technology into HPD Announcements of Opportunity

(AOs). The funding would allow some of the recipients to stay with universities rather than having to go to the private sector. Dr. McDonald is working to determine what exists and what is needed, as he does not want to create a new program unless it is the right program.

In the area of international collaboration, HPD recently formalized a working group charter with the Korea Astronomy and Space Science Institute (KASI). A kick-off meeting was scheduled for September. NASA has also been working with the Japanese Space Agency (JAXA) and the European Space Agency (ESA) on a multilateral science objectives team to study a next-generation solar physics mission using the Solar-C concept. Both JAXA and ESA have proposed Solar-C internally multiple times, but it has not been selected. Therefore, the three agencies are jointly assessing the ground capabilities and science objectives. The group may create or modify objectives, then propose some mission concepts. There may be overlap with some other JAXA projects, so that is being examined, and the group will look at joint objectives. The draft report is planned for April 2017, with the final report to come out in July. One issue is whether the mission should be broader. The United States is also partnering with ESA on the Thor mission. Anyone who wants to fly flight hardware will have to propose through the appropriate calls. NASA's international partners understand the Agency's selection process. Keeping everything in sync requires close coordination of timeframes for decisions.

Dr. Vassilis Angelopoulos pointed out that the M5 mission is coming up, which will generate proposals. There is an issue of teams competing against each other. Mr. Clarke said that he would be interested in talking about this further. If there are U.S. entities interested early on, he can alert ESA. Dr. Elliott asked if there were any precedent for having a common call for both ESA and NASA. Mr. Clarke said that he would find out. Budget is always a concern. It was noted that the Solar Orbiter went through the coordinated call process, which is not competed. Mr. Clarke said that that is what the Agency is doing for the M4 mission. He went on to explain that the Indian Space Research Organization (ISRO) working group charter is in the approval process. The intention is to model solar activities, have joint observations and data analysis, and do ground observations.

Mr. Clarke next reported that NASA is seeking to shift the four science subcommittees to full Federal Advisory Committee Act (FACA) committees. Many of the community-based studies will then report to the new Heliophysics Advisory Committee (HPAC). All HPS members will shift over to HPAC, and the chair will continue serving on the NAC Science Committee. HPAC will report to him directly instead of routing findings and recommendations up through NAC and back down to him. The new structure will also allow Mr. Clarke to establish subordinate groups. Ms. Elaine Denning, NAC Executive Secretary, explained that this was decided upon by the NASA Administrator, Mr. Charles Bolden, in the spring. The charters and membership balance plans have been drafted and are being reviewed internally before going to the General Services Administration (GSA). Following GSA approval, there will be a public notification, after which the restructuring plan will be filed with Congress. There is no timeframe for completion. Mr. Clarke added that the Senior Reviews (SRs) and Space Technology Definition Teams (STDTs) now report to the Division. Under the new structure, they will report to HPAC. Ms. Denning pointed out that this will send advice directly to where it is needed instead of through a loop. The subcommittees have been operating like FACA committees, but to this point only NAC is an official FACA committee. That will change.

Flight Program Status

Dr. Joseph Smith of HPD showed the timeline for the Division's missions from 1995 to 2025. Five missions are in development, with two launches planned for 2017 and three for 2018. The cadence will pick up from there. It has been almost a year since MMS began commissioning, and it is doing very well, with papers published in Geophysical Research Letters (GRL). The mission team has resolved a star tracker issue. There are workshops and conference sessions planned for the next several months.

SET-1 was delivered some time ago for a spring 2017 launch. The pacing item is the launch vehicle, a SpaceX Falcon Heavy. The Ionospheric Connection Explorer (ICON) has four instruments and is approaching Key Decision Point D (KDP-D), which is integration and testing. An open issue is the orbital debris waiver, which is being reviewed at GSFC. The Global-Scale Observations of the Limb and Disk (GOLD) mission recently completed some significant testing and is now in thermal vacuum testing. The plan is to launch in spring of 2018. At this point, there are no concerns. Solar Probe Plus (SPP) recently went through KDP-D, with the pre-environmental review scheduled for October. Plans are for a summer 2018 launch. There are no issues at this time. ESA did the final mission Critical Design Review (CDR) for the Solar Orbiter Collaboration (SOC) in June, with plans to launch in the fall of 2018. NASA has been working closely with ESA, especially on scheduling, and opening up communications. NASA has two SOC instruments in process. Milestones include the pre-environmental and pre-shipment reviews for the instruments. HPD is watching the schedule risk to the launch date.

The “stoplight chart” was almost entirely green, though ICON and SOC had some yellow blocks. ICON’s issue is the debris, and scheduling is the issue for SOC. Dr. Jeffrey Hayes added that there had been a space debris issue with the Interface Region Imaging Spectrograph (IRIS), but that has been resolved. The software is uploaded and working perfectly.

Dr. Smith next explained that HPD manages the sounding rocket program for SMD, demonstrating and executing technologies. He presented the upcoming launch plan. Mr. Clarke described a launch from White Sands, NM, that had a failure and resulted in new lessons learned. The sounding rocket program has a flexible team bringing good value.

Mr. Clarke confirmed that there are no concerns on SPP at the moment. SOC has been a watch item regarding schedule for a while now, and NASA remains concerned. There is now more instrument team involvement with the bus team to ensure better alignment of the timeline, but the Agency will continue watching carefully. ESA needs to work through all of the issues that have been identified, while NASA will have to look at what this does to the funding and the science. This remains his primary concern. ESA has put out a call for space mission operations, and NASA is assessing options for proposing. One consideration is whether the Agency can provide funding, which was not in the budget profile. If the schedule slips, the gravity assist window will remain good through 2019. Anything past that requires a completely new trajectory analysis.

Heliophysics Science Performance Assessment

Ms. Jennifer Kearns of SMD provided the background of GPRAMA, which requires each Federal entity to provide a strategic plan, an annual performance plan, and an annual performance report to evaluate progress made in key areas. In SMD, the measures address milestones for missions and development.

In NASA’s Annual Performance Plan, HPD has three Annual Performance Indicators (APIs) Plan, against which HPS is asked to assess progress:

1.4.1 is to demonstrate progress in exploring the physical processes in the space environment from the Sun to Earth, and throughout the solar system.

1.4.2 asks HPD to demonstrate progress in advancing understanding of the connections that link the Sun, Earth, and planetary space environments, and the outer reaches of the solar system.

1.4.3 seeks to demonstrate progress in developing the knowledge and capabilities to detect and predict extreme conditions in space, to protect life and society, and to safeguard human and robotic explorers beyond Earth.

HPS was to make a high-level assessment of science performance and general sense of progress for each API. Dr. Kessel had sent the members a document with items to consider, but they were free to add to or delete the suggestions. They were to provide several examples in each area, along with brief, explanatory text. This was particularly important for yellow or red ratings, described below.

The color ratings are as follows:

- A rating of Green means that the expectations of the research program were fully met in context of the resources invested;
- Yellow means that there were some notable or significant shortfalls, but some worthy science advancements were achieved; and
- Red means that there were major disappointments or shortfalls in scientific outcomes in context of resources invested, uncompensated by other unusually positive results.

In previous years, the SMD subcommittees provided introductory text for each API, but that is no longer needed and was to be cut if included, though HPS could write them for SMD's benefit. Although the dates do not match up exactly, the evaluation was for FY16. HPS was free to evaluate anything that occurred during the last year, though they were only to consider items funded in whole or in part by NASA. That funding did not need to come from HPD specifically. SMD had a strong preference for research published in peer-reviewed journals. The evaluations should also be made in context of the budget. Questions about the direction of the program should be addressed elsewhere. SMD needed an official, recorded vote for each API, and the document was to be written for the intelligent layperson.

In discussion, Ms. Kearns stated that the papers cited were to have been published during the previous 12 months. Dr. Kessel added that if something was missing from her document, HPS members were welcome to add it. HPD does not have the staff to review all of the journals. As far as NASA funding was concerned, that could apply to researchers who received NASA funds. Ms. Kearns reminded HPS that the minimum requirement was the rating. The results go into the performance report, which is then sent to OMB and Congress. It is also available to the public. The inputs are not used for anything else. Dr. Michael Liemohn noted that in previous years, HPS included three or four science highlights for each API. Ms. Kearns confirmed that that is still appropriate. Dr. Dahlburg said that the examples should support the rating, but they are highlights, , [so although they need to include references they do not need to be lengthy](#).

Heliophysics Science Performance Assessment, Input for the FY2016 NASA PAR – Review and Assignments

Dr. Dahlburg recommended having seven or eight pages for each area. Previously, HPS broke up into three groups, one for each area. As this had worked well, she decided to continue the practice and asked the three chairs from the previous year to serve again. Dr. Bart De Pontieu had chaired API 1.4.1 and was participating online; Dr. Leibacher would assist him in the meeting room. Dr. Angelopoulos chaired 1.4.2, and Dr. Liemohn chaired 1.4.3. Dr. Dahlburg asked the remaining members to join one of the three groups, evaluate the examples provided, and think about whether there might be a need for additional items. She broke down the schedule for drafting, revising, and finalizing the three sections.

Lunch Science Presentation: Mary Voytek, "NExSS: The Nexus of Exoplanet System Science, an Interdivisional Research Initiative"

Dr. Mary Voytek of the Planetary Science Division (PSD) described this cross-division effort, which aims to maximize research through coordination. Exoplanet research cuts across all of SMD, and NExSS is meant to leverage programs and break down barriers by enabling communication. The program relies on a virtual coordination network. Measures of success include proposing inter-disciplinary research through new collaborations, producing plans for use of current telescopes, enhancing international engagement,

influencing the upcoming PSD and APD Decadal Surveys, spawning ideas for new missions, and more. Dr. Voytek described the selection and composition of each team. She noted that someone will need to fill Dr. Newmark's position as HPD lead.

There are a number of focus areas in NExSS. One is habitability, for which liquid surface water on the surface is key. Dr. Voytek and the HPS members agreed that this effort also illustrates how important it is to pull in information from all of the divisions. Since she is with PSD, Dr. Voytek begins from the planetary perspective. She noted that heliophysics is needed to address detection of planetary magnetospheres, stellar winds, and radiative habitability.

There are 16 projects funded by SMD calls, with about 207 participants. The teams began meeting in 2015 and now have monthly webinars and Principal Investigator (PI) teleconferences, along with a website and mailing list. The PIs are supposed to engage the community. The effort has already generated a white paper, "Laboratory Work for Understanding Exoplanet Atmospheres," which identified future measurement needs that will feed into ROSES calls. The paper also supported three workshops, the first of which has been held in conjunction with NSF and addressed features in spectra that help determine habitability. NSF is a potential partner.

PSD and APD jointly led a biosignatures workshop in July that focused on pending APD missions and mission studies. There is an upcoming workshop related to heliophysics, which will focus on exoplanetary space weather, climate, and habitability in order to identify the stars that are best to search for habitable planets and life. Dr. Voytek noted that when it comes to the details of detecting life, they came up with the term "bio-hints" where there is no real signature that can be detected.

Dr. Voytek explained that in some respects, the group is still organizing. While the workshops are not open for attendance, they are available online and there is a breakout group for the call-ins. Dr. Dahlburg asked if there had been consideration of orbital debris as technology signatures. Dr. Voytek replied that she had not heard that concept before, but she liked it. There are other workshop and collaboration possibilities. Social media efforts have benefitted from the assistance of a former Washington Post science reporter.

This group has not discussed non-carbon-based lifeforms, though PSD has considered them and the National Research Council (NRC) did a "weird life" report. She gave examples of possible waxy life forms and some alternative chemistries work. There is the "disturbance in the force" theory as well. Extremophiles are all over Earth, and most metabolisms occur at most temperatures. That is what makes researchers think there are lots of places to look, instead of just Earth 2.0.

Subcommittee Work Session

HPS members worked on the GPRAMA report.

High-End Computing Status

Dr. Tsengdar Lee, the High End Computing (HEC) program executive for SMD, described the state of NASA's HEC capability project and its support of heliophysics.

SMD manages the HEC Capability (HECC) project for the Agency, as science users require the most capacity. Among those, the Earth Science Division (ESD) is the largest user. About one third of the HECC budget focuses on technologies refresh, leading to a continuously increasing capability. The annual budget for this effort is about \$42-43 million, and that budget is spent. As of 2016, HECC has maxed out the current facility and has no capacity to address expanding programmatic requirements even if additional programmatic funding is provided. Meanwhile, needs grow in all disciplines.

In these situations, cloud computing has limited applicability. SMD is working with the Chief Information Officer to shift some of work into the cloud, however. The computing allocations are based on 2006 data. In that construct, APD receives 21.7 percent of the capacity, ESD has 53.8 percent, HPD is allotted 13.9 percent, and PSD gets 10.6 percent. This is about half of NASA's entire capability, the rest going mostly to human exploration and aeronautics. SMD is flexible with the allocations, moving unused capacity to those who need it. However, those needs are growing. APD now funds large-scale computation projects and ESD does some complex modeling, for example.

Demand in FY16 is almost twice capacity, and projected requests will triple capacity by FY22. Dr. Lee said that there is some high-resolution modeling as well. He showed the heliophysics requests, capacity, and allocation. The requests are well beyond the capacity and allocation. HECC does not have the resources to respond to the community's needs. Using other divisions' unused portions is no longer an option, as those divisions have increased their own use.

The mitigation strategy includes the following steps:

- Build a facility to allow future expansion;
- Tie HEC resource needs to the budget planning process;
- Give SMD's science divisions the flexibility to buy more resources as needed, though only when the facility is available;
- Work with the science community through the normal strategic planning process to understand the relative priority of HEC.

The concern is that computing capacity could constrain science, and that is the direction in which this is headed. Dr. Lee showed a rendering of a modular supercomputing facility prototype, which is essentially a container that has cooling elements, and another sketch of a large facility with many of these modules. The facility is the ideal. He reviewed the needs of the modules for cooling and space. He is currently presenting these sketches in order to get approval of this scheme, which will be located close to the Ames Research Center (ARC) in California. The structures are concrete housing to which he hopes to add modules each year. The entire module would be replaced on schedule, though not the concrete structure. If something can be used further, it will be, but the racks will still be replaced. There is a substation at Ames; Dr. Lee was not sure about the source of power, but it is probably not coal. The Stennis Space Center (SSC) has a computing center, but HEC already has a lot of equipment at Ames, and he would like to keep it there rather than break it up and move. To do so would involve replication, among other things. In addition, HEC has a very favorable rate for power at Ames. The cool and dry air of the area will help cool the computing and bring down costs. This will be much less expensive than a comparable facility in a warmer climate.

Budgeting is a fundamental issue, in that the science divisions award projects without the computing resources to back them up. He is proposing within SMD that HEC be treated as a limited resource. SMD will allocate planned HEC resources during the proposal evaluation and award process. The review panel must have the expertise to evaluate the proposals, and the proposers need to be able to articulate what they need. That means the program scientists will have to manage that when assembling panels. This constitutes an additional constraint.

SMD divisions could buy more resources as needed, but only if SMD had the proposed facility, as there is a lack of physical space. The divisions will need to work with the science community so they understand the priority of HEC. The cost of the fully loaded facility, with each rack being \$600,000, will be about \$150 million. Dr. Lee was seeking support for this business model, in which program and budget elements are coupled. Dr. Matthaeus said that some investigators want to use their own local clusters,

which can be more efficient. Dr. Lee replied that this program is about the Agency adding computing power. It does not prevent the divisions from doing work at the university level. Dr. Hayes added that this has always been a shared resource, and it has always been free to the user. SMD has ignored that fact up to this point and now needs to think of a new paradigm. It is a priority issue.

Dr. Lee said that renegotiating the allocations among the divisions would not solve the problem. However, there is a proposal that would adjust the allocation and have near-term impact. It is still being vetted. The oversubscription issue will remain regardless, however. He showed a graphic of availability versus demand. The ratio is getting worse. The proposed facility does not include new racks, it just allows SMD the flexibility to buy more racks. In near term, the reallocation could help at the edges.

HEC does not set the priorities on small and large missions and grants, but rather allocates the resource to the divisions. Mission design typically receives priority, but again, that is determined by the divisions, not HEC. Dr. Hayes added that the problem was not severe until this year. This will require prioritizing missions versus science, which could be done better. Mr. Clarke said that this is a relatively new but significant problem, and SMD is working through the process.

Risk Tolerance/CubeSats

Dr. Dahlburg explained that at the previous HPS meeting, there was discussion of risk management. The Subcommittee was concerned that with cubesats being new, inexpensive, and fascinating, there was no clarity on the risk management strategy, which Dr. Newmark was there to address.

Dr. Newmark began by saying that it has been a pleasure working with HPS during his time in HPD. Not all cubesats and smallsats are the same. They can come to SMD through ROSES, in which case they are explicitly governed by the document 7120.8, which has requirements that are less stringent than other documents. The second class of cubesats might be proposed in response to an AO. These are governed by the explicit AO requirements. In addition, SMD is taking another look at Class D and possibly subdividing it at three levels. The current HPD AO cites Class D, but the proposers can tailor their proposals. For example, if they state that certain requirements are not applicable, the proposal is evaluated that way. Mr. Clarke noted that SMD has been studying Class D for a while. Dr. Elliott asked about the frequency and success of tailored proposals, which other HPS members said were not uncommon. Dr. Newmark added that SMD is looking for success.

Dr. Daniel Moses of NASA said that this relates to something HPS should consider. When HPD approves cubesats for the Low-Cost Access to Space (LCAS) program, there is an assumption of limited time. In fact, cubesats can last a long time and produce an immense amount of data. He asked what, as a community, is best for data, archiving, etc. There is no process for continuation, and he thought there should be a policy on this. Dr. Dahlburg said that this could be discussed the next day and, if need be, at a future meeting.

Discussion/Adjourn for the Day

Dr. Dahlburg led the Subcommittee in discussing the agenda for the next day. Dr. Matthaeus suggested they address the funding of postdocs and Federal labor standards, which has come up as a new issue at universities. Dr. Roger Smith added that most universities are worried about this because many postdocs are being treated as if they are salaried employees, when in fact they are more like hourly employees. Mr. Clarke recommended holding off until the next meeting so that information could be gathered.

Dr. Dahlburg said it might be worthwhile, [for the next HPS meeting](#), to invite speakers from NSF, the Department of Energy (DOE), and the Department of Defense (DOD) to discuss how they handle high-performance computing needs. Dr. Ralph McNutt said that he had heard that there were rumblings in

OMB about going to cloud computing, but that is a mismatch for science. There are communication issues as well. So he would like to hear from others. Dr. Dahlburg asked members to send specific thoughts to Dr. Kessel.

Dr. Dahlburg adjourned the meeting for the day at 5:09 p.m.

Tuesday, August 9, 2016

Call to Order

Dr. Dahlburg opened the second day of the meeting by recapping the first day's activities and reviewing the remaining agenda items.

R&A Update/Compliance

Dr. Arik Posner provided an update on the R&A program, beginning with the HPD ROSES 2016 status. The success rates remain low, but the expectation all along has been that this would be a bad year. The situation will improve when the DRIVE initiative goes into effect. Mitigation has involved some rephrasing. The number of awards could increase by about one third if the amount for the first year of the awards is lower. This involves a lot of work behind the scenes. Dr. Kessel explained that in FY18 and FY19, HPD will be essentially doubling the R&A funding as part of a long-term strategy. It was actually worse before now. Dr. Angelopoulos observed that if prospects leave the field, it is demoralizing, so it is important to state the actual numbers that will be given using the DRIVE strategy, which will be greater.

Dr. Posner showed the funding levels for the various R&A programs, noting that the FY17 President's budget is still being reviewed by Congress. He then presented a graph comparing the number of proposals received to the percentage selected in each R&A program. HPS had previously recommended that the R&A program increase the award size and/or decrease the number of pages for submissions. Therefore, as a pilot effort, HPD reduced the number of pages required for the Heliophysics Supporting Research (HSR) program and increased the HSR award size. There is also now a requirement that PIs or science leads invest 30 percent of their time in the effort. While postdocs cannot be PIs in most cases, they can be science leads. This also cuts down on the frequency with which PIs might lead more than one study.

Breakthrough results [can be difficult to solicit from the R&A community](#), and HPD does not have the staff to review the science results. Dr. Liemohn suggested asking for the most significant result, which Dr. Kessel observed could be an HPS recommendation. Dr. Tobiska noted that LWS is starting to populate proposals and grants with papers, and wondered if that process would apply to non-LWS projects. Dr. Posner said that it would, and that HPD is expanding to allow the PIs to populate the website. The award paperwork says that PIs are to send in significant results. Drs. Dahlburg and Elliott cited cases in which scientists [who are comfortable with the peer review journal format](#) were reluctant to promote their work [in popular literature also](#).

Dr. Kessel explained that there is a new website for submitting papers to be considered for press events and journal articles. Anything that is high profile ought to be submitted. Dr. McNutt surmised that part of the problem is that this is one more thing to do, and it needs to be made efficient. The website sounds like a good idea, but how does HPD motivate PIs to take advantage of it? Dr. Angelopoulos added that often scientists are modest and do not want to brag. Dr. Dahlburg asked that HPD send the website link to HPS members so that it can be on the agenda for a future meeting.

Dr. Hayes offered that this was an issue of scientists being proactive in order to get credit, especially in R&A, which is exceptionally important to the community. Congress needs to see that it is important, and

the way to do this is with published papers. Dr. Elliott noted that NSF asks proposers to state publication results from prior proposals, a practice that might encourage people to publicize their work.

Dr. Kessel next raised the issue of Heliophysics Guest Investigator (HGI) proposal compliance issues. After a review panel pointed out a proposal with some gross noncompliance issues, R&A had someone check all of the proposals. This person found substantial violations. The guidebook gives formatting requirements, and while most proposals complied with the font size, many used smaller fonts. There were also issues with margins. An investigation of 2015 proposals found the same problems. It is time-consuming to deal with this. Dr. Kessel showed the data from a recalculation of the characters and lines per page. Just over 50 percent of the proposals were within the guidelines.

After a second compliance check, program staff sorted proposals into three categories: noncompliant, warning only, and compliant. For this year, proposals over 5 percent of the guideline were deemed noncompliant. At the time of the meeting, these notifications had not yet gone out. Dr. McNutt wondered why R&A did not use the same guidelines as the missions so that there is consistency across HPD. He added that if proposers go outside the guidelines, they are cheating and the proposals should be tossed. If they cannot do that right, maybe they cannot do the work precisely enough.

Dr. Matthaeus said that PIs already spend a large fraction of their time on accountability and compliance issues. This is not a good solution for underfunding. He suggested that the reviewers deduct for these violations. Dr. Kessel said that that would not work. Dr. Matthaeus cautioned that they would end up evaluating the documents rather than the content. Mr. Clarke said that SMD prefers to have guidelines and requirements, and he favors a stricter approach. He noted that PSD throws out noncompliant proposals, which the HPD program scientists do not want to do. HPD is working on updating the language on R&A and AO calls in order to make the requirements consistent. HPD will send out warnings on the ones that have been reviewed and will have clearer language going forward. This is an issue across all of SMD. It does take a lot of work, but NASA needs fair guidelines and requirements. This is not something to impose on the panels.

Dr. Dahlburg pointed out that because [the proposals are](#) web-based, HPD could mandate the total number of characters. This idea was favored by a couple of HPS members, because some panelists would sometimes like to read larger fonts, not smaller ones. Dr. Liemohn endorsed a strict approach, because there are significant advantages to those who are noncompliant when they slip in extra content.

Mr. Clarke said that HPD has the responsibility to enforce compliance rules and the latitude to do so as the Division sees fit. He likes the warning to those who are within 5 percent of the guidelines while tossing those that are more than that. Dr. Kessel added that the 5 percent is just for this year. Dr. Neil Murphy observed that once proposals are rejected, word will get out to the community. Dr. Posner said that HPD will ensure the guidelines are something they can enforce. Dr. Tobiska approved, noting that the approach sends a message that R&A has identified problems and is being proactive. Otherwise, some proposers are gaming the system.

Dr. Posner said that the results of the compliance check show that 18 proposals would be noncompliant; of these, 4 were highly rated and fundable. Another 12 would receive warnings, and 2 of those are in the fundable category. The issue of characters versus font size came up again. Dr. Tobiska said that as both a proposer and a reviewer, he advocated a standard look and feel that allows the panelists to pick things out. Dr. Hayes said that there is an argument that NASA should provide a template, though he prefers to not do that. Mr. Clarke said that this is being addressed across SMD.

SWAP/LWS Update

SWAP Update

Dr. Elsayed Talaat provided an update on Space Weather Action Plan (SWAP) activities. The National Space Weather Strategy and SWAP were released in 2015. The action plan addressed six goals, which he reviewed. All but “improve protection and mitigation efforts” involve NASA.

Under the goal of “benchmarking for space weather events,” SWAP will look at five areas, and NASA is involved in all of them. Dr. Talaat gave the example of the ionizing radiation benchmark. To address this, the team convened a working group with cross-agency membership, and held weekly teleconferences, developing methodologies to extrapolate to a 1-in-100-year benchmark. Another goal is “to improve space weather services through advancing understanding and forecasting,” with an action to “improve effectiveness and timeliness for the process that transitions research to operations.” The example Dr. Talaat gave here showed how the process was divided between research agencies and operating agencies. A modeling concept has been proposed. It is anticipated that the heliophysics science centers will do research feeding into this. There will be an Operations to Research (O2R) workshop soon.

The final goal Dr. Talaat discussed is “to increase international cooperation.” To that end, there have been some workshops. A specific action is for the Department of Commerce (DOC) and NASA to continue efforts to promote within the Coordination Group for Meteorological Satellites (CGMS) an ongoing agenda item on space weather activities, to get space weather tasks integrated into core CGMS activities.

Dr. Angelopoulos said that as satellites transition to smaller, multi-satellite missions, it might be possible for them to operate as a network of sensors, comparable to buoys. This would be for the future, maybe 10 years out, to produce real-time information and space weather forecasts. Dr. Talaat thought this was an interesting idea. NASA participates in CGMS because the Agency recognizes that a lot of the instruments can be used for both research and operations. One challenge would be setting standards. Dr. Tobiska noted that there are standards being developed internationally, especially regarding the particle environment. It is very active. He is the U.S. delegate and would be happy to share information on that.

LWS Update

Dr. Talaat said that the recently issued ROSES 2016 had three different focus topics developed from three prior steering committee reports, which he reviewed. LWS has some mandatory funding proposed in the FY17 PBR, but the ROSES elements for FY17 do not depend on that and the selections will go forward. There is a new procedure for Targeted Research and Technology (TR&T).

HPD is seeking more community input into TR&T science topics. Efforts to obtain this input include announcements with newsletters, conference presentations, and an online town hall in April. After soliciting anonymous suggestions for science topics, the program received 57 recommendations, which it then combined and condensed into 13 topics. Along with two additional topics added by the program to reflect community input, these were posted online for comment. Dr. Talaat listed the 15 topics. The next step is to finalize the topics.

Dr. Angelopoulos asked about the FY17 calls for LWS. Dr. Talaat explained that the call that just came out will not be affected by any additional funding that might come through. HPD has strategized how to deal with various funding levels, and the hope is that new funding will allow the program to set up new opportunities. LWS will grow with DRIVE funding. Dr. Kessel noted that the final report could be changed by HPS, which will need to consider it. The Subcommittee review is not meant to be a rubber stamp. Dr. Dahlburg said that this will be discussed further at the next meeting.

Heliophysics Science Performance Assessment, Input for the FY2016 NASA PAR -Working

HPS reviewed progress on the GPRAMA report. Dr. De Pontieu explained that the group for the first topic chose three examples, dealing with sunspot formation; heating mechanisms in the solar winds, plus

modeling; and reconnection. Dr. Angelopoulos reported that group two had chosen three topics as well: new insights on how solar activities affect Earth and the planets; atmospheric wave coupling to the edge of space; and the sun's interaction with the interstellar medium. Dr. Liemohn said that the third group examples addressed Earth's mesopause region and clouds, as indicative of climate change; Van Allen probes and magnetic field modeling; and understanding and predicting trajectories of interstellar particles.

Panel Surveys

Dr. Kessel explained that for ROSES 2015-16, R&A surveyed PIs via Survey Monkey. The feedback was generally considered helpful, though those who were funded were more positive. The scores were considered consistent with the comments, but those who submitted their proposal at least once before said the feedback was not consistent from one year to another.

As noted previously, HPS asked R&A to try 10-page proposals, and this was piloted with HGI. When asked about the effect of the shorter proposal, most panelists considered it adequate and easier to review. Dr. Matthaeus gave the example of some European calls with two-page proposals. Dr. Kessel agreed that something shorter than 10 pages could help, though she would want to provide a template. Dr. Murphy agreed, citing a very successful ESA call with eight-page proposals. Dr. Elliott was concerned that a reduction would impinge on the proposers' discussion of methodology.

Dr. Smith told of his experience as a panelist. The comment is often made that proposers do not explain everything. A shorter proposal would have to be evaluated differently. Several other members agreed, noting that there would probably be more citations and a greater need to show prior metrics. Dr. Angelopoulos thought it would be premature to go lower without first implementing the 10-page proposals more broadly and surveying the proposers. Dr. Kessel agreed, adding that HPD might need to split up the survey among subdisciplines. She added that R&A has also used tertiary reviewers, which the surveyed panelists liked; they liked mail-in reviews as well. It is hard to find nonconflicted panelists, so the program uses some reviewers from teams with multiple investigators. It will help to implement DRIVE, with its additional funding, and to hold a proposal-writing workshop.

She asked if there should be more surveys. Dr. Angelopoulos said it sounded like some proposers would appreciate more and better feedback. He wondered if there might be a way to capture reviewer comments and send them back. Dr. Kessel said that that is not done because the scoring is based on the summary evaluation, which is what HPD sends out. The reviewers differ in the amount they write. She would like to have another proposal workshop. The survey is useful because it offers an opportunity to provide feedback. She read the comments and shared them with the R&A staff.

Dr. Matthaeus speculated that a combination of shorter proposals and a second round of refereeing might work. Dr. Kessel said that it is up to the proposal writer to be clear and convey the message. With DRIVE, more people will be funded, so it will shift their mindset because they will either be funded or have better likelihood of receiving funds.

Discussion

The three GPRAMA topic groups reviewed their work for the entire group in order to receive comments.

Dr. Dahlburg then reviewed her working list of findings and recommendations. There was some clarification from Dr. Kessel that the noncompliant reviewers, those receiving warnings, and those who were compliant will receive different letters. Dr. Dahlburg added to her list that HPD would like an update on the Class D subdivision, as well as the long-lived [LCAS](#) cubesats, at the next meeting. Dr. Smith noted that cubesats are meant to be short-lived, so their reentry or destruction should be planned. Dr. Tobiska disagreed, citing the investigations that produce valuable data. Dr. McNutt cautioned against

a situation that has cubesats in a Senior Review. They need to stay in LCAS. Dr. Dahlburg said that that warrants a briefing at the next meeting.

Dr. Liemohn agreed to write a piece on the need to publicize press-worthy research results, stating that HPD should publicize the website for promoting research results, and a template should be created for that. It is difficult to get the results of R&A, and while scientists are modest, they need to help NASA by showing the results. Without promulgating these achievements, HPD will not know the full scope of accomplishments from its efforts in order to pass them along to Congress. Dr. Kessel agreed that HPD could develop a template for research highlights and include examples.

Dr. McNutt raised a new issue. NASAwatch.com had a link to a spaceref.com article about new estimates of space radiation risks that are favorable for human exploration of Mars. The 68-page PDF reflected a colloquium held on July 13. Dr. McNutt reviewed the credentials of the main author, who has led a lot of radiation research. However, Dr. McNutt did not think the article sufficiently addressed the fact that some of the biological impacts are totally unknown. A person is not exposed to high-energy cosmic rays until they are beyond the magnetosphere. Thus far, that would include only people who have been on the moon, and half of the lunar astronauts died of heart disease. The article contains a lot of discussion about mortality, but it is all probabilistic. The article also cites a controversial paper. He raised the issue because it comes across as if the space community has overstated the case on people and radiation. He was unsure of the extent to which the article would get traction, and he thought that Mr. Clarke should be aware of it.

Dr. Tobiska said that the author's perspective has value and he has been invited to speak to an aviation radiation team. There is a lot of controversy in this community. Dr. McNutt was concerned that the biological studies cited lack high confidence. Due in part to the many variables with animals, it is very hard to tease out cause and effect. Dr. Dahlburg wanted to come back to this.

Heliophysics Science Performance Assessment, Input for the FY2016 NASA PAR – Final Work and Voting

Dr. Dahlburg asked each group leader to report, after which HPS would vote. Dr. De Pontieu led Group 1, which addressed API 1.4.1, “to demonstrate progress in exploring the physical processes in the space environment from the Sun to Earth, and throughout the solar system.” He and Drs. Leibacher, Murphy, and Matthaeus were on this group, and proposed to find that NASA remains on track in this area. The first example, having to do with formation of sunspots, dealt with complex information and demonstrated how the Heliophysics System Observatory (HSO) and high-end computing are critical for advancing the science. The second example dealt with heating processes and acceleration of the high-temperature plasma known as the solar wind. Recent surveys of winds, as well as comparisons to numerical simulations, have revealed differing behaviors for various particle sizes. The third example showed the MMS and IRIS focus on the magnetic reconnection process, along with new measurements revealing finer detail than ever before.

The group recommended that HPS vote Green. There were no comments, and the vote for a Green rating was unanimous.

Dr. Angelopoulos reported the work of Group 2, which included Drs. Elliott and Smith. They covered API 1.4.2, which asks that HPD “demonstrate progress in advancing understanding of the connections that link the Sun, Earth, and planetary space environments, and the outer reaches of the solar system.” HPD has had outstanding contributions in this area. In the first example, data have revealed that the timing of solar flares can be predicted, to indicate when the solar wind comes by Earth. The solar wind en route to the outer edges of solar system evolves. This advances the ability to predict space weather. The second example shows how the lower atmosphere is coupled to the edge of space and the Earth. Finally, Group 2 chose an example of solar wind interactions with the interstellar medium. NASA science has

now identified the processes by which this takes place, enabling better modeling. Group 2 believed that HPD made significant progress in this area over the last year.

The group recommended that HPS vote Green. There were no comments, and the vote for a Green rating was unanimous.

For Group 3, which included Drs. Tobiska and McNutt, Dr. Liemohn gave three examples in support of API 1.4.3, which asks HPD to “demonstrate progress in developing the knowledge and capabilities to detect and predict extreme conditions in space, to protect life and society, and to safeguard human and robotic explorers beyond Earth.” NASA data and models across all heliophysics disciplines were used to this end, with notable multi-year and multi-satellite data. The first highlight found that the colder and more humid upper atmosphere points to a new extreme boundary in space. This means that climate change is affecting the boundary conditions of outer space. There was also a comparison to extreme space weather events on Mars. Second, the Van Allen probes provided a breakthrough in global magnetic field modeling capabilities. The final example cited improved understanding, and projecting trajectories, of solar energy particles. These are driven by coronal mass ejections. The group found that NASA has met the standard here and therefore recommended a Green rating.

After some wordsmithing, HPS voted unanimously for a rating of Green. Dr. Dahlburg thanked the members for their hard work and gave them a deadline for sending in their final versions.

Discussion

Dr. Dahlburg reviewed the additions to the HPS letter [report for the NASA Advisory Council's Science Committee](#), including the request for more on how other agencies manage high-performance computing, the discussion of long-lived cubesat mechanisms to consider operations, and updates on SWAP and the 10-page ROSES call limit. Members added the upcoming SWAP workshop, the status of the science centers and international collaboration teams, and fair labor standards vis-à-vis postdocs. The next HPS meeting will be in the fall and will likely be a teleconference.

Dr. Liemohn expressed concern about the plan to have the Senior Reviews report to HPAC. It was not clear why that would happen, and it would cause most members to have a conflict of interest. Others agreed. Dr. McNutt recalled that PSD had a situation come up in which there were so many conflicts on a Senior Review that NASA had to call in the Office of the General Counsel. It would be worse for HPAC. Dr. Kessel agreed that it could be problematic. Other reports will not come through HPAC, and it was unclear why the Senior Reviews would be an exception. Dr. Dahlburg noted that HPS had had its annual ethics training that day. When this issue arose, the attorney leading the training promised to research it.

Discussion turned to the article Dr. McNutt found about human exploration on Mars. His main concern was that Mr. Clarke should be aware of it. The author's point is that galactic cosmic rays are a frequent occurrence that must be considered. Biology is a complex field with a lot of empirical data, and there is nothing on how bad these particles are. Part of the argument is that biology needs to be funded. Dr. Dahlburg advised having Dr. McNutt show the article to Mr. Clarke after the meeting, as it seemed to be outside the scope of the HPS meeting wrap-up session.

Debrief with Heliophysics Division Director

Dr. Dahlburg began the debriefing by stating that HPS congratulates Drs. Newmark and Le on their new positions, and was glad to hear that Mr. Clarke got a waiver of the hiring freeze. The Subcommittee was also glad to have Dr. McDonald working with HPD. HPS approved of the increased cadence of AOs and the international collaborations. The Subcommittee thanked Dr. Smith for the flight program briefing and

congratulated HPD for its progress with MMS and other missions. She noted the GPRAMA task, then turned the meeting over to the three group leads.

Dr. De Pontieu described Group 1's activities in addressing API 1.4.1. The first example, having to do with formation of sunspots, dealt with complex information and demonstrated how HSO and high-end computing are critical for advancing the science. The second example dealt with heating processes and acceleration of the high-temperature plasma known as the solar wind. Recent surveys of winds, and comparisons to numerical simulations, have revealed differing behaviors for various particle sizes. The third example showed the MMS and IRIS focus on the magnetic reconnection process, along with new measurements revealing finer detail than ever before.

Dr. Angelopoulos reported the work of Group 2 on API 1.4.2. In the first example, data have revealed that the timing of solar flares can be predicted, to indicate when the solar wind comes by Earth. The solar wind en route to the outer edges of solar system evolves. This advances the ability to predict space weather. The second example shows how the lower atmosphere is coupled to the edge of space and the Earth. Finally, Group 2 chose an example of solar wind interactions with the interstellar medium. NASA science has now identified the processes by which this takes place, enabling better modeling.

For Group 3, Dr. Liemohn gave three examples in support of API 1.4.3. The first highlight found that the colder and more humid upper atmosphere points to a new extreme boundary in space. This means that climate change is affecting the boundary conditions of outer space. There was also a comparison to extreme space weather events on Mars. Second, the Van Allen probes provided a breakthrough in global magnetic field modeling capabilities. The final example cited improved understanding, and projecting trajectories, of solar energy particles. These are driven by coronal mass ejections.

Dr. Dahlburg reported that all three APIs were rated Green.

She next thanked Dr. Voytek for her talk, and noted Dr. Lee's update on HEC. HPS wanted to hear more at the next meeting, including discussions from other agencies regarding funding, planning, volume, and other issues. On cubesats, Dr. Newmark gave a helpful presentation, and HPS sought an update on the future subdivisions of Class D, as well as a briefing from Dr. Moses on long-lived cubesats.

Dr. Liemohn raised the point that HPD should promote the website for R&A research highlights, and should provide a template. It is difficult for HPD staff to pick through these, and when they come in at all, they are in different formats. If this action is not taken, HPD will not know the full scope of this work, which will adversely affect HPD in dealing with Congress.

Dr. Dahlburg reported that HPS agreed with the compliance system implemented with proposals. The Subcommittee appreciated Dr. Talaat's presentation and is glad that most SWAP actions are on target. They would like to hear more about that, the workshop, and the new LWS process. The panel survey presentation led HPS to note that comments need to be consistent across panels from one year to another, but otherwise the process is good. The implementation of DRIVE will help, and HPS would like to see proposal-writing workshops, broader surveys, and an expansion of the 10-page proposal to other areas.

Dr. Matthaeus noted that the Fair Labor Standards Act is about to be applied at universities in regard to postdocs. Most institutions have not budgeted for this, and PIs who have postdocs with research grants should see if the funding agencies will add funds to raise these salaries.

Dr. Liemohn pointed out that one of the HPAC charts had the Senior Reviews reporting to HPAC, which is a concern as many on HPAC would have a conflict of interest. Mr. Clarke said he would bring this up with the other divisions. He thanked HPS for their time and effort, especially on the GPRAMA

assessment. HPD is trying to make things more efficient and transparent, so he always wants input. The input on Senior Reviews is particularly important.

Adjourn

The meeting was adjourned at 5:09 p.m.

Appendix A Attendees

Heliophysics Subcommittee members in attendance

Jill P. Dahlburg, Naval Research Laboratory, Chair

Vassilis Angelopoulos, UCLA

Bart W. De Pontieu, Lockheed Martin (via phone)

Heather A. Elliott, Southwest Research Institute

John William Leibacher, Association of Universities for Research in Astronomy

Michael W. Liemohn, University of Michigan

William H. Matthaeus, University of Delaware

Ralph L. McNutt, Jr., Johns Hopkins University

Neil Murphy, Jet Propulsion Laboratory

Roger W. Smith, University of Alaska

William Kent Tobiska, Space Environment Technologies

Ramona Kessel, NASA HQ, Executive Secretary

NASA Attendees

Steve Clarke, HPD Director

Bryan Diederich

Elaine Denning

T. Jens Feeley

Chris Gietsmoni

Madhulika Guhathakurta

Jeffrey Hayes

Jennifer Kearns

Tsengdar Lee

Liz McDonald

Jeff Morrill

J. Daniel Moses

Jeffrey Newmark

Jacob Parsley

Arik Posner

Michael Sablom

Joe Smith

Bill Stabnow

Erol Summerlin

Elsayed Talaat

Katya Verner

Mary Voytek

Alan Zide

Other Attendees

David Gump, Deep Space Industries

NAC Heliophysics Meeting Minutes, August 8-9, 2016

Ben Kallen, Lewis-Burke Associates
Elizabeth Sheley, Ingenicomm
Ana Wilson, Ingenicomm

Appendix B Subcommittee Membership

Jill P. Dahlburg, Chair

Naval Research laboratory

Ramona Kessel (Executive Secretary)

NASA HQ

Dr. Vassilis Angelopoulos

UCLA

Dr. Spiro Antiochos

NASA GSFC

Bart W. De Pontieu

Lockheed Martin

Heather Elliott

Southwest Research Institute

Lynn Kistler

University of New Hampshire

John William Leibacher

Association of Universities for Research in Astronomy

Michael W. Liemohn

University of Michigan

William Matthaeus

University of Delaware

Ralph L. McNutt, Jr.

Johns Hopkins University

Neil Murphy

Jet Propulsion Laboratory

James Russell III

Hampton University

Roger Wilford Smith

University of Alaska - Fairbanks

William Kent Tobiska
Space Environment Technologies

Appendix C Presentations

1. *Heliophysics Division Overview*, Steven Clark
2. *Flight Program Status*, Joseph Smith
3. *FY16 Heliophysics Science Performance Assessment (GPRAMA)*, Jennifer Kearns
4. *High End Computing Status*, Tsengdar Lee
5. *R&A Update/Compliance*, Arik Posner, Mona Kessel
6. *SWAP/LWS Update*, Elsayed Talaat

Appendix D Agenda

Heliophysics Subcommittee Meeting August 8-9, 2016

Monday August 8; 3H42

9:00	Welcome, Overview of Agenda	J. Dahlburg, HPS Chair
9:10	Heliophysics Division Overview	S. Clarke, NASA HQ
9:30	Flight Program Status	J. Smith, NASA HQ
9:50	Risk Tolerance/CubeSats	Subcommittee

10:20 BREAK

10:30	Heliophysics Science Performance Assessment Input the FY2016 NASA PAR – Overview	J. Kearns, NASA HQ
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11:00 Heliophysics Science Performance Assessment, input for Subcommittee
the FY2016 NASA PAR – Review and Assignments

12:30 LUNCH: Science Presentation: Mary Voytek, "NExSS: The Nexus of Exoplanet System Science, an interdivisional research initiative."

1:30	Subcommittee work session(s)	Subcommittee
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3:15 BREAK

3:30	High-end computing status	T. Lee, NASA HQ
4:30	Panel Surveys	M. Kessel, NASA HQ
5:00	ADJOURN	

Tuesday August 9: 3H42

9:00	Call to order, recap	J. Dahlburg, HPS Chair
9:10	R&A Update/Compliance	A. Posner/M. Kessel, NASA HQ
9:50	SWAP/LWS update	E. Talaat, NASA HQ

10:30 Break

10:45	Heliophysics Science Performance Assessment, input for the FY2016 NASA PAR -Working	Subcommittee
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12:15 LUNCH

1:15	Heliophysics Science Performance Assessment, input for the FY2016 NASA PAR -Working	Subcommittee
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3:15 Break

3:30	Heliophysics Science Performance Assessment, input for the FY2016 NASA PAR – Final Work and Voting	Subcommittee
4:15	Discussion, including future meeting dates, potential agenda topics, action items	Subcommittee
4:30	Debrief with Heliophysics Division Director	S. Clarke, NASA HQ
5:00	ADJOURN	